

1. Differentiate Fuzzy logic and crisp logic.

Ans.

Fuzzy logiccrisp logic

- It has imprecise properties.
- It has precise properties.

- It supports partial membership.
- It supports full membership

Ex. Yes \rightarrow No

Exp. Yes or No

True \rightarrow False

True or False

1 \rightarrow 0

1 or 0

- It is continuous valued logic
- It is binary logic

- It is a membership function
- It is an indicator function.

- The degree, to which Ben showed up
Ben was punctual can be identified by on how much earlier or later showed up.
- If Ben showed up precisely at 12 he is punctual otherwise he is too early or too late.

2. Explain non-monotonic reasoning in detail.

Ans. - In this some conclusions may be invalidated if we add some more information to knowledge base.

- Non-monotonic reasoning deals with incomplete and uncertain models.
- "Human perceptions for various things in daily life" is a general example of non-monotonic reasoning.

Let suppose the knowledge base contains the following knowledge:

- Bird can fly
- penguins cannot fly
- pity is a bird

so from above sentences, we can conclude that pity can fly.

- Advantages :-

- for real-world systems such as robot navigation, we can use non-monotonic.
- we can chose probabilistic facts or can make assumptions.

- Disadvantages :-

- The old facts may-be invalidated by adding new sentences.
- It cannot be used for theorem proving.

3. Solve crypt-arithmetic puzzles.

A) SEND + MORE = MONEY

B) BASE + BALL = CRAMES

Ans.

I) SEND + MORE = MONEY

$c_4 \ c_3 \ c_2 \ c_1$

SEND

+ MORE

MONEY

$M=1$

M must be 1

Now,

$$C_3 + S + M = 10 + 0$$

$$0 + S + I = 10 + 0$$

$$S = 9 + 0$$

$$\boxed{S = 9}$$

$$\boxed{0 = 0}$$

$$C_2 + E + O = N$$

if we select $C_2 = 0$

$$0 + E + O = N$$

$$E = N$$

Not possible

$$\text{so } C_2 = I$$

$$I + E + O = N$$

$$\boxed{I + E = N} \rightarrow \text{store it}$$

$$C_1 + N + R = 10 + E$$

$$C_1 + I + E + R = 10 + E$$

$$C_1 + R = 9$$

if we choose $C_1 = 0$ then $R = 9$

$$\text{so } C_1 = 9 \text{ so } \boxed{R = 8}$$

$$D + E = 10 + Y$$

if $E = 5$ then $N = 6$

$$D = 5 + Y$$

$$\text{if } Y = 2 \Rightarrow D = 7$$

$$\boxed{E = 5}$$

$$\boxed{N = 6}$$

$$\boxed{D = 7}$$

$$Y = 2$$

S E N D	9	5	6	7		
T M O R E	+	1	0	8	5	
M O N E Y		1	0	6	5	2

2) BASE + BALL = CRA MES

$$CR = 1$$

$$\begin{array}{c}
 \boxed{C = S} \\
 E + L = S \quad [NO]^{C_{400y}} + \xrightarrow{\text{BASE}} \text{BALL} \\
 E + L = S + 10^{[C_{400y}]} \xrightarrow{\text{CAMES}}
 \end{array}$$

$$E = S - L + 10$$

$$S + L = E$$

$$S+1 = S-1 + 10$$

$$2L = 10$$

$$L = 5$$

B A S E

BALL

AMES

Digitized by srujanika@gmail.com

Now,

$$E + L = S$$

$$S - E = L$$

S - f = 5

(g, 4)

$$(S, E) = (5, 0) \setminus (8, 1) \cup (7, 2) \cup (8, 3)$$

$$B + \underline{B} = A + \text{Carry}$$

$$B = \begin{pmatrix} 5 & x \\ 6 & 7 \\ 8 & 9 \end{pmatrix}$$

Let $B = \{7\}$, $(S, E) = (8, B)$

$$\text{we get } A = 4$$

7 4 8 3

784595

1 4 9 3 8

4. Solve 8-puzzle problem.

Initial state

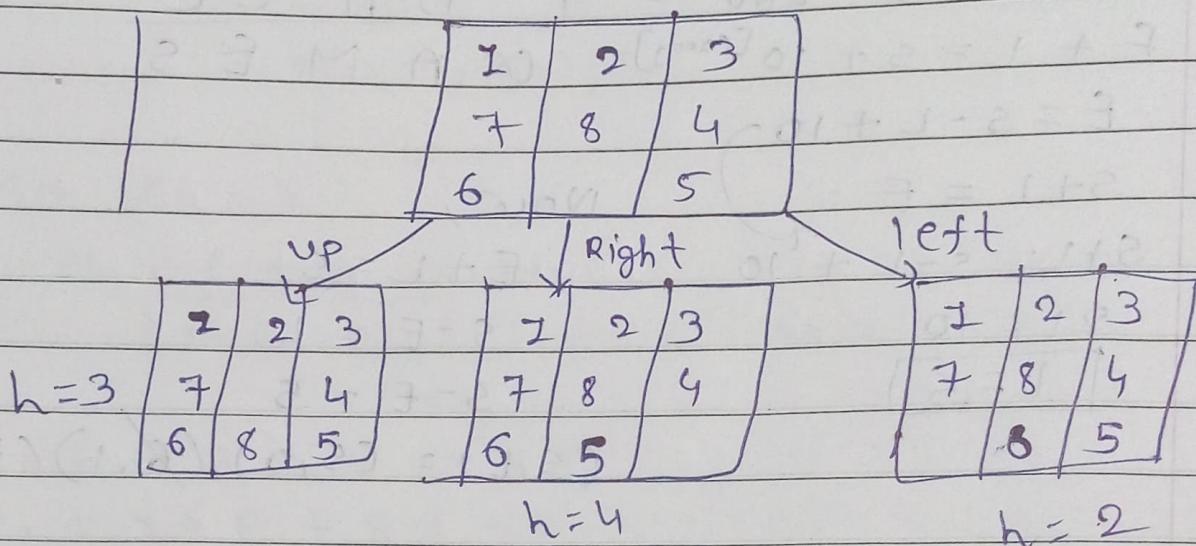
1	2	3
7	8	4
6		5

goal state

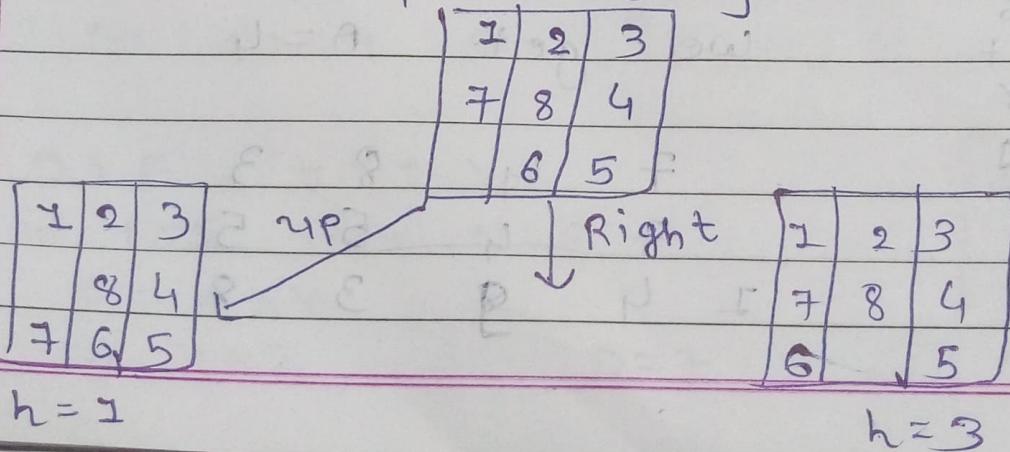
1	2	3
8		4
7	6	5

Ams:-

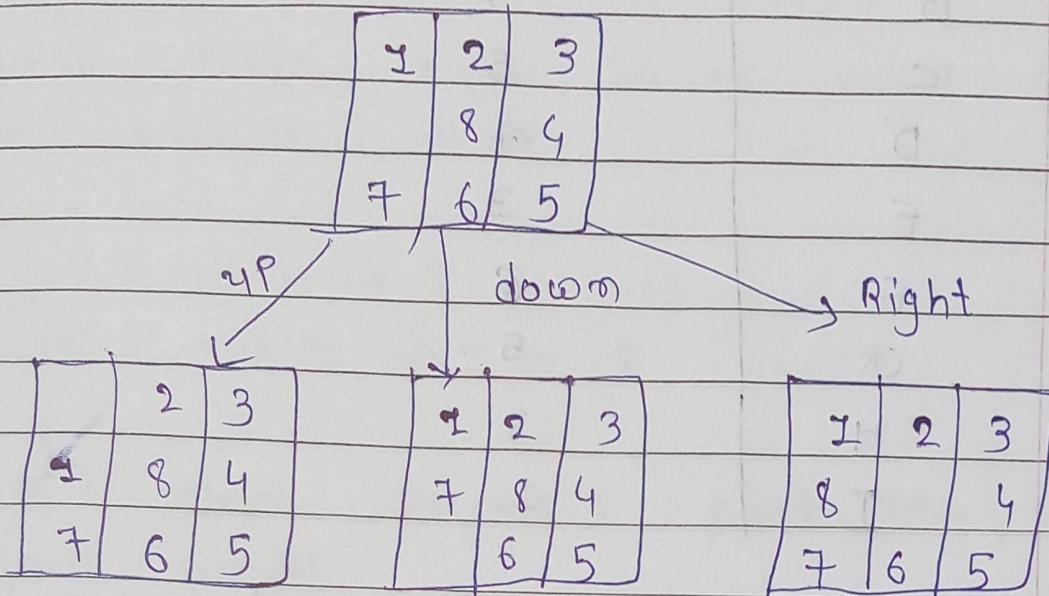
here $h=3$



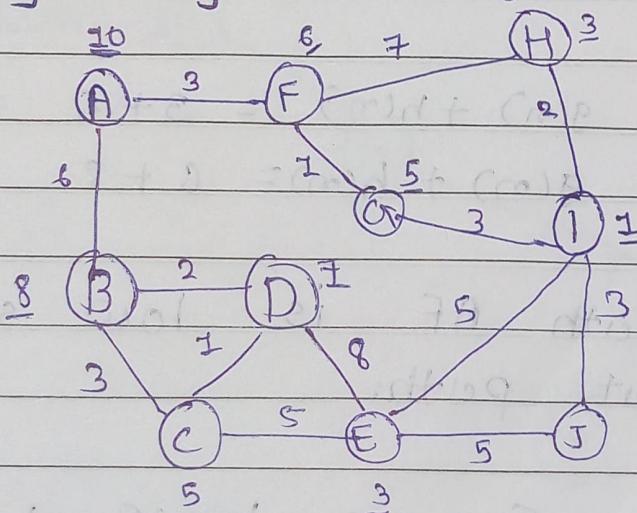
heuristic value of last element is low so explore only that



here heuristic value of first one is low so explore only that one.



5. Apply A* algorithm on following graph.



Node	heuristic value
A	10
B	8
C	5
D	7
E	3
F	6
G	5
H	3
I	1

- Our starting node is A and goal mode is J.
- we have two path to reach goal mode

$$A \rightarrow F = g(m) + h(m) = 3 + 6 = 9 \checkmark$$

$$A \rightarrow B = g(m) + h(m) = 6 + 8 = 13$$

Cost of path AF is low so we select that path.

Now, From F we have two paths,

$$A \rightarrow F \rightarrow H = 10 + 3 = 13$$

$$A \rightarrow F \rightarrow CR = 4 + 5 = 9 \quad \checkmark$$

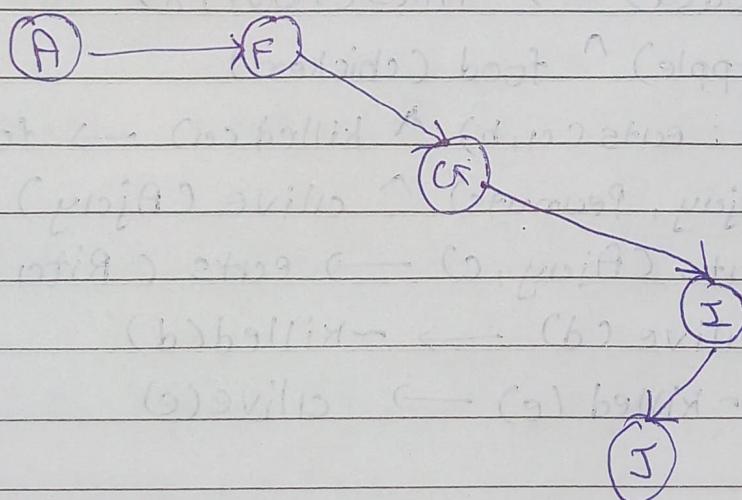
here AFCR has lower cost so we select it that we will find.

$$A \rightarrow F \rightarrow H \rightarrow I = 13$$

$$A \rightarrow F \rightarrow CR \rightarrow I = 8 \quad \checkmark$$

we select AFCRIJ path to reach goal node.

$$\text{total cost} = 8$$



(shortest path) \leftarrow (about 10%)

6. Describe following facts into predicate logic form and prove using resolution that ravi likes peanuts.

1. Ravi likes all kind of food.
2. Apples and chickens are food.
3. Anything anyone eats and is not killed is food.
4. Ajay eats peanuts and is still alive.
5. Rita eats everything that Ajay eats.

Ans:-

\Rightarrow Convert statement into predicate logic

1. $\forall x : \text{food}(x) \rightarrow \text{likes}(\text{Ravi}, x)$
2. $\text{food}(\text{Apple}) \wedge \text{food}(\text{chicken})$
3. $\forall a : \forall b : \text{eats}(a, b) \wedge \text{killed}(a) \rightarrow \text{food}(b)$
4. $\text{eats}(\text{Ajay}, \text{Peanuts}) \wedge \text{alive}(\text{Ajay})$
5. $\forall c : \text{eats}(\text{Ajay}, c) \rightarrow \text{eats}(\text{Rita}, c)$
6. $\forall d : \text{alive}(d) \rightarrow \neg \text{killed}(d)$
7. $\forall e : \neg \text{killed}(e) \rightarrow \text{alive}(e)$

Conclusion: $\text{likes}(\text{Ravi}, \text{peanuts})$

⇒ Convert into CNF

i. $\neg \text{food}(x) \vee \text{likes}(\text{Ravi}, x)$

ii. Food (apple)

iii. Food (chicken)

iv. $\neg \text{eats}(a, b) \vee \text{killed}(a) \vee \text{food}(b)$

v. Eats (Ajay, Peanuts)

vi. Alive (Ajay)

vii. $\neg \text{eats}(\text{Ajay}, c) \vee \text{eats}(\text{Rita}, c)$

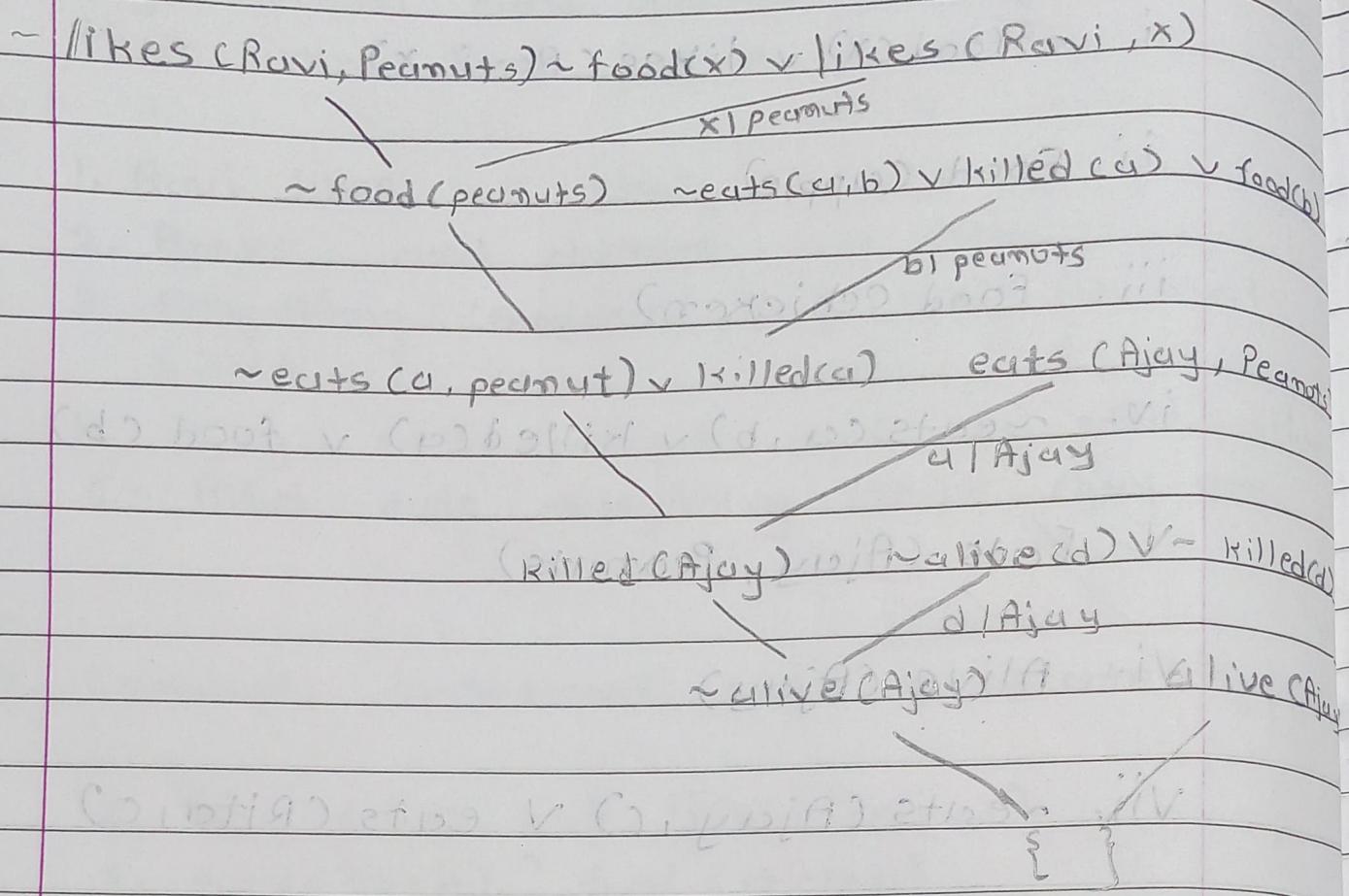
viii. $\neg \text{alive}(d) \vee \neg \text{killed}(d)$

ix. Killed (e) \vee Alive (e)

$\neg \text{likes}(\text{Ravi}, \text{Peanuts})$



Resolve using Resolution.



7. Prove that "west is criminal"
using forward and backward chaining.

1. It is a crime for a criminal to sell weapons to hostile nations.
2. All the missiles were sold to mono by west.

3. The country mono is enemy of america

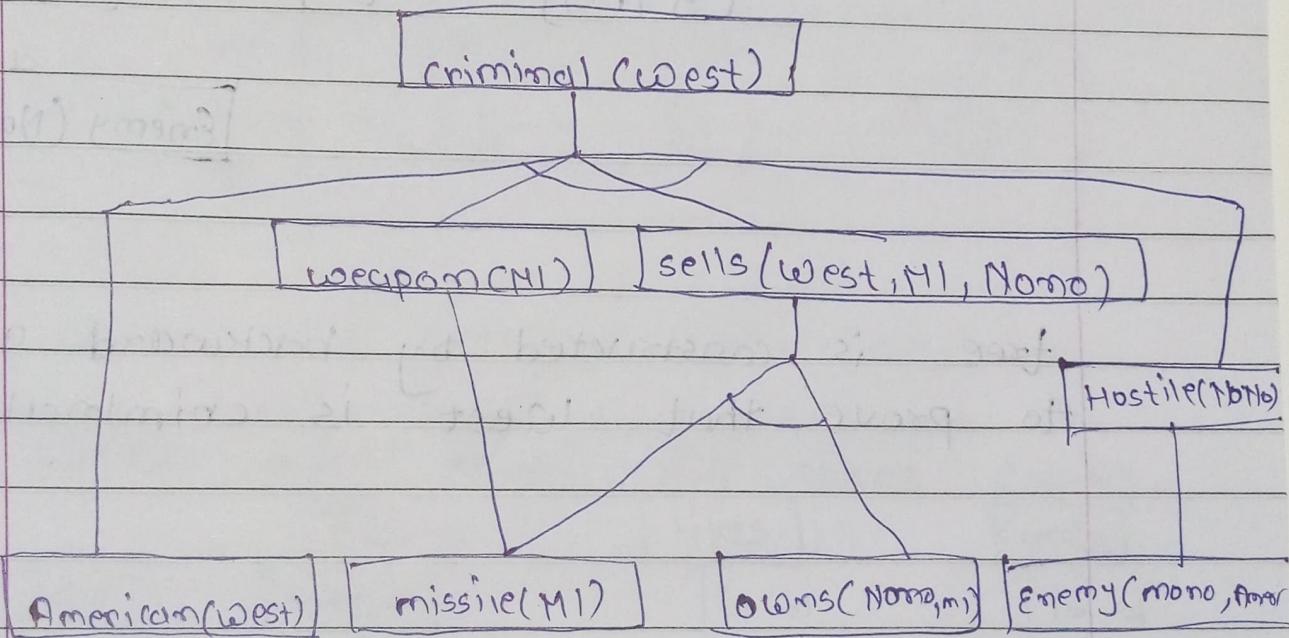
4. An enemy of america counts as hostile.

5. Nono has some missiles

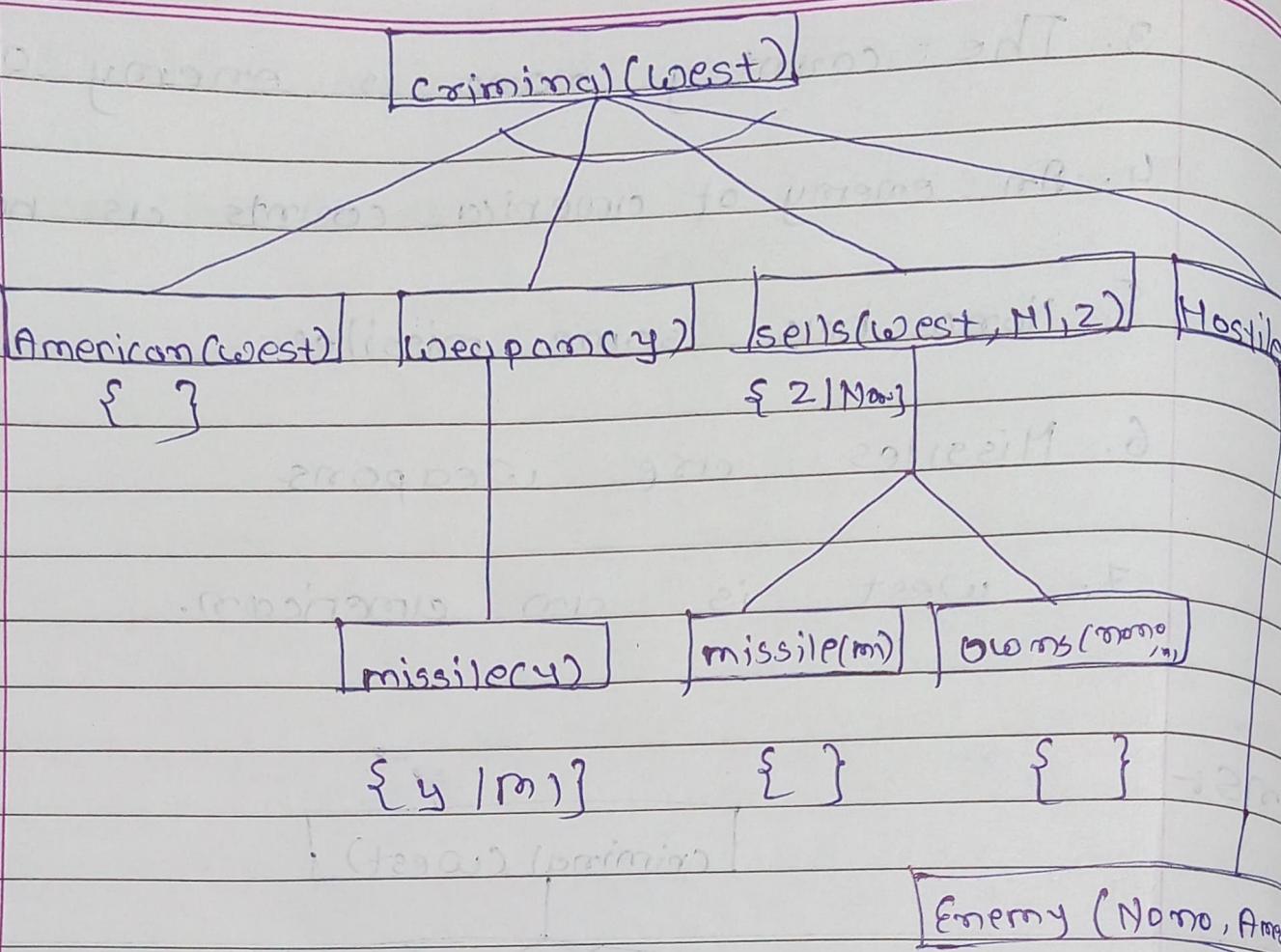
6. Missiles are weapons

7. West is an american.

Ans:-



- The law says that it is crime for America to sell weapons to hostile nations, the country mono, an enemy of America missiles were sold to it by west so west is criminal.



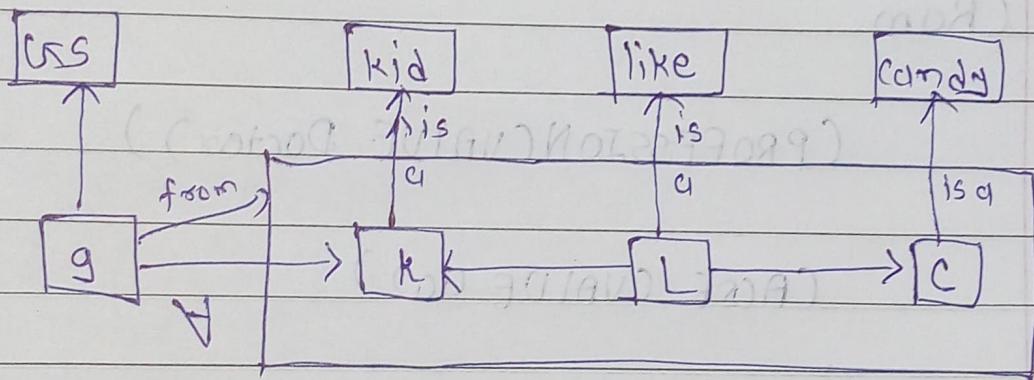
tree is constructed by backward chaining to prove that West is criminal.

8. Draw semantic Net for following statements.

- A) Every kid likes candy
- B) Every school going kid likes candy

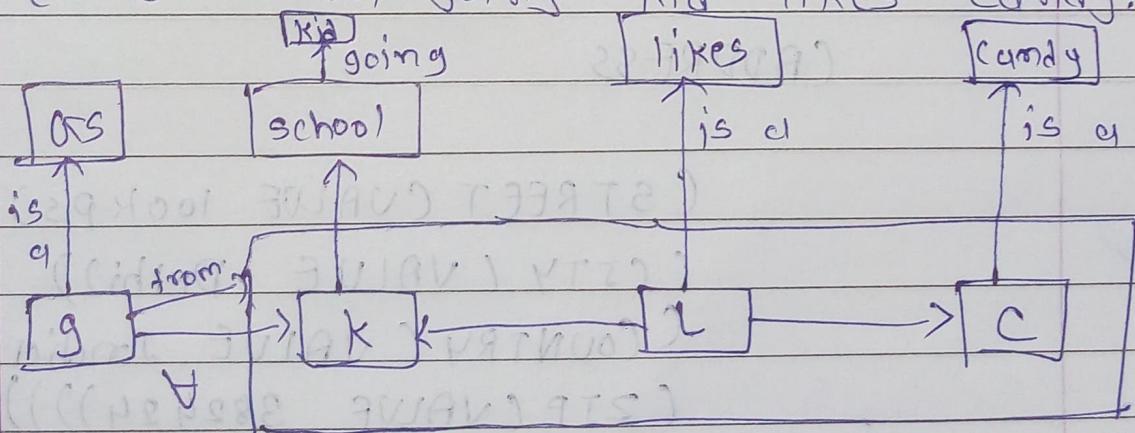
Ans.

A) Every kid likes candy.



where GRS: general statement

B) Every school going kid likes candy.



9. Create frame of the person Ram who is doctor. He is of 40. His wife is sita. They have two children Babu and sita criter. They live in 100 kps street in the city of Delhi in India
zip - 382424

Ans.

(Ram

(40)

(doctor)

(40)

(India)

(PROFESSION (VALUE Doctor))

(AGE (VALUE 40))

(WIFE (VALUE sita))

(CHILDREN (VALUE Babu, erita))

(ADDRESS

(STREET (VALUE 100kps))

(CITY (VALUE Delhi))

(COUNTRY (VALUE India))

(ZIP (VALUE 382424))))